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UTILIZATION SECTION PROGRAMS 1985-86

Report No 85-265-K

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ABSTRACT

An overview is given of the major projects planned for the Utilization Section 1985/86. For each project area, the purpose, some detail and the deliverables are described.

job	file	date	report no.
740612-572-011	814	September 20, 1985	85-265-K

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To Mr. F.J. Kee
Director of Research

UTILIZATION SECTION PROGRAMS 1985-86

Utilization Section Objective

The objective of the Utilization Section of the Research Division is to provide technological innovation and support to improve customer benefits and power system utilization through energy management and the use of electricity.

Our plans are based on the prediction that it will become increasingly important to match the load to the generating capacity. For the immediate future, substitution of electricity for other fuels will be required to support the Marketing plan. However, strategic conservation will become increasingly important as the excess generating capacity is used up and new generating facilities are not committed.

Industrial electrification will also take on an increased importance in order to keep Ontario's industrial base competitive. At present, very little electricity is used in industrial processes. However, new technologies such as microwave, heat pumps, plasma, lasers, etc, offer opportunities to industry to improve the competitive position through higher quality and improved efficiency. In addition, a strong industrial base means a strong provincial economy. As well as new initiatives in the industrial sector, continued support will be given to both the residential and commercial sectors.

Introduction to Catalog

This catalog is intended to provide an overview of the major work programs in the Utilization Section of the Research Division. It is divided into three market sectors: Industrial, Residential and Commercial to align with the organization of the Marketing Operations Division. Within each section, a brief overview is given of the objectives, methods and the deliverables of the major programs. Enquiries should be directed to the project engineer whose name and phone number are listed on the overview page. Detailed information (ie budget, completion date, etc) on each of the approximately one hundred projects making up the major programs may be obtained from the project record form system at the Research Division.

As is the nature of the research, our programs are evolving over time. We welcome your interest and invite your input.

Approved:

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Submitted:

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CATALOG ENTRIES

Industrial

- Product Drying by Dehumidification
- Product Drying with Radiant Electrotechnologies (Microwave, Radio-frequency and Infra-red)
- Heat Pump Heat Recovery
- Metal Processing with Electricity
- Industrial Service Entrances (for Electric Boilers)

Residential

- Residential Heat Pumps
- Residential Water Heating
- Supplementary and Dual-fuel Heating
- Building Science
- Residential Service Entrances

Commercial

- Commercial Applications of Heat Pumps
- Commercial Water Heating

"Research Division/Utilization Section Programs 85/86"

SECTOR: Industrial

TOPIC: Product Drying by Dehumidification

MARKET SEGMENT: Replacing fossil fuel fired central steam with point of use electricity based processes in product drying, food processing, and separation processes.

OBJECTIVE: To develop and demonstrate product drying concepts and systems employing heat pump dehumidification techniques aimed at improving the economics of drying compared to fossil heated systems. To develop drying application analysis tools to aid in the technical and economic assessment of potential applications.

DETAIL:

The objectives will be achieved through the execution of an integrated approach that includes:

1. Product Assessment: Test facilities and procedures to evaluate product drying characteristics will be developed.

2. Modelling - Computer based analysis tools will be developed to aid in the assessment of opportunities for dehumidification drying and the optimization of dehumidifier performance.

3. Dehumidifier Test Chamber - A physical test facility will be constructed. This will allow potential users to participate in trials of new dehumidifier applications and provide verification of predicted drying performance.

DELIVERABLES:

1. Product assessment facilities (ie test ovens and analysis procedures) to determine the suitability of candidate processes for dehumidification drying.

2. Application models to assess the feasibility of replacement of fossil heated product dryers with heat pump dehumidification systems.

3. A functioning dehumidification drying system suitable for demonstrating this form of drying to potential users.

CONTACT: J.T. (Terry) Strack (122+6723)

"Research Division/Utilization Section Programs 85/86"

SECTOR: Industrial

TOPIC: Product Drying with Radiant Electrotechnologies (Microwave, Radio-frequency and Infra-red)

MARKET SEGMENT: Replacing fossil fuel fired central steam with point of use electricity based processes in product drying, food processing, and separation processes.

OBJECTIVE:

(a) To evaluate the use of radiant technologies for industrial product drying and identify promising opportunities.

(b) To develop a fundamental understanding of dielectric (microwave and radio-frequency) and infra-red radiant heating.

DETAIL:

The objectives will be met by using the following approach:

1. Product Assessment - Microwave, radio-frequency and infra-red heating equipment to evaluate product drying characteristics will be designed and installed in the industrial electroheat laboratory.

2. Database Development - Laboratory evaluations, technical references and consultations with equipment designer/ manufacturers and other experts will be used to assess radiant technology opportunities.

3. Computer Modelling - Computer analysis techniques will be employed together with laboratory evaluations to aid in the optimization of radiant technology systems.

DELIVERABLES:

1. Industrial microwave, radio-frequency and infra-red heating systems will be installed in the industrial electroheat laboratory for the purpose of demonstrating and developing drying processes for potential users.

2. Guidelines for use by corporation to identify new application opportunities for radiant technologies. Included will be identification of successful existing applications worldwide.

CONTACT: S.J. (Steve) Oda (122+6722)

"Research Division/Utilization Section Programs-85/86"

SECTOR: Industrial

TOPIC: Heat Pump Heat Recovery

MARKET SEGMENT: Replacing fossil fuel fired central steam with point of use electricity based processes in product drying, food processing, and separation processes.

OBJECTIVE: To develop and assess heat recovery concepts and systems employing heat pumping techniques aimed at improving the economics of material processing compared to fossil heated systems. To develop heat pumping analysis tools to aid in the technical and economic assessment of potential applications.

DETAIL:

The objectives will be achieved by carrying out preliminary feasibility assessments of new opportunities for heat pump and mechanical vapour recompression systems.

Specific activities include:

1. Application Assessment - Analysis of heat pumping opportunities will be conducted.

2. Modelling - Computer based analysis tools will be developed to aid the assessment of opportunities for heat pumps.

DELIVERABLES:

1. Assessment of candidate applications to determine their suitability as a heat pump heat recovery opportunity.

2. Application models to assess the feasibility of replacing fossil heat processes with heat pump heat recovery systems.

CONTACT: J.T. (Terry) Strack (122+6723)

"Research Division/Utilization Section Programs 85/86"

SECTOR: Industrial

TOPIC: Metal Processing with Electricity

MARKET SEGMENT: Replacing point of use fossil fuel fired processes with point of use electricity bases processes in metal melting, and heat treating.

OBJECTIVE: To assess opportunities for the use of electro-technologies in the melting and fabricating of metal and metal products. To investigate methods of improving performance and/or reducing the capital cost of electroheat equipment.

DETAIL:

The objectives will be achieved by carrying out preliminary feasibility assessments of new opportunities for selected electrotechnologies, by reviewing developments in the electroheat field and by discussing and demonstrating changes to electroheat equipment.

Specifically:

1. Plasma Heating - Assess the feasibility of using plasma torches to replace existing oxy/fuel burners on arc furnaces.

2. Plasma Equipment Costs - Demonstrate a low-cost AC plasma torch alternative as one method of lowering the capital cost of plasma heating equipment.

3. Electric Cutting - Review electric cutting techniques.

4. Induction Melting - Review opportunities to improve induction melting equipment efficiency.

DELIVERABLES:

1. Preliminary technical and economic feasibility assessment of replacing oxy/fuel burners on arc furnaces with plasma torches.

2. Information on the cost of plasma equipment and data on cost reduction potential of using AC devices.

3. Information on the technical and economic advantages of cutting metals with plasma torches and lasers.

4. Information on improvement possibilities for induction melting equipment.

CONTACT: J.T. (Terry) Strack (122+6723)

"Research Division/Utilization Section Programs-85/86"

SECTOR: Industrial

TOPIC: Industrial Service Entrances (for Electric Boilers)

MARKET SEGMENT: Replacing large fossil fuel fired boilers with large electric boilers in southern Ontario.

OBJECTIVE: Identify methods of reducing the cost of electric boilers through savings on the service entrance installation.

DETAIL:

Document cost effective approaches to installing service entrances for large electric boilers through literature review, discussions with customers and electrical equipment manufacturers.

DELIVERABLES:

Guidelines which can be used by Marketing to advise customers on the most economical approaches to upgrading existing services.

CONTACT: C.E. (Carl) Keyes (122+6506)

SECTOR: Residential

TOPIC: Residential Heat Pumps

MARKET SEGMENT: Space heating, air conditioning and water heating in new and existing houses.

OBJECTIVE: Support marketing efforts by testing, evaluating, and keeping up to date with residential heat pump technology, products and programs.

DETAIL:

1. Undertake a major study of heat pump reliability that will allow homeowners to make an informed choice of heating system and heat pump brand. The study will consist of three related investigations:

   a) Accelerated reliability testing under laboratory simulated high stress conditions.

   b) Tap into reliability and service information from other utilities through participation in EPRI's field studies.

   c) Direct, through CEA, a research survey into Canadian heat pump reliability data that can be used to predict service life and maintenance costs.

2. Carry out field evaluations of promising bi-valent heat pumps such as the new Kool-Fire "Low Temperature" heat pump. Such machines offer increased utility load factors and lowered cost of service.

3. Investigate passive (fanless) outdoor evaporators to determine the performance of these quiet heat pumps.

4. Represent Ontario Hydro on the CSA Technical Committee for Heat Pumps in the revision of Standard C273.3. Initiate round robin testing of heat pumps to verify this standard with particular attention to sound level measurements.

5. Evaluate the performance of a Carrier and a Cantherm ground source heat pump. As a class, such systems are expected to increase utility load factors and protect declining water heater load.

6. Investigate cost cutting methods for installing ground source heat pumps.

7. Conduct "Alternate Day" monitoring for the Ontario Hydro designed northern climate heat pump being built for CEA by KeepRite.

8. Maintain the Ontario Hydro Environmental Test Facility for Heat Pumps and conduct tests of novel heat pump hardware to inform Marketing about the full range of equipment available to homeowners in this area.

9. Maintain international contact with heat pump researchers via such groups as the IEA heat pump committee.

DELIVERABLES:

1. Valuable reliability information will be obtained on heat pumps.

2. Recommendations on ground source heat pump use in Ontario will enable Marketing to develop a stance on this new product.

3. Development of a Canadian Heat Pump Standard which will include sound level measurements in response to consumer concerns.

4. Recommendations on the use and applicability of Kool-Fire heat pumps.

5. Recommendations on the use of novel hardware such as passive outdoor evaporators.

CONTACT: D.J. (Dave) Young (122+6815)

Research Division/Utilization Section Programs 85/86"

SECTOR: Residential

TOPIC: Residential Water Heating

MARKET SEGMENT: Water heating in new and existing housing market.

OBJECTIVE: Meet the continually evolving need of the Corporation relative to efficient energy use for water heating purposes in the residential sector.

Assist Marketing to protect the declining water heating load by developing higher performance electric water heaters, making recommendations for the use new water heating technologies and evaluating the competition.

DETAIL:

1. Monitor the marketplace for innovative energy efficient water heaters and perform evaluation tests as required.

2. Assess technical innovations to improve the thermal performance of existing water heaters and assist in developing novel heat recovery systems (ie exhaust air/ventilation and waste water heat recovery).

3. Study the effectiveness of existing electric water heaters with regard to delivery capability and customer satisfaction using the newly-developed ASHRAE/OHRD residential hot water use patterns.

4. Conduct preliminary investigations on Legionella bacteria in residential water heating installations.

5. Provide consultations to Residential Marketing as required.

DELIVERABLES:

1. Recommendations for optimization of thermal performance of existing water heaters.

2. Advise on the use and effectiveness of residential heat recovery systems.

3. List of opportunities for the use of new water heating technologies in the residential sector.

4. Advice concerning Legionella bacteria in water heating systems and required action.

CONTACT: M. (Maier) Perlman (122+6196)

Research Division/Utilization Section Programs 85/86

SECTOR: Residential

TOPIC: Supplementary and Dual Fuel Heating

MARKET SEGMENT: Supplementary Heating/Electric Dual-Fuelled Space Heating

OBJECTIVE: Determine and demonstrate ways in which electric resistance space heating can be added to existing and new structures. Improve performance and cost effectiveness of existing and new heating systems.

DETAIL:

1. Review published information on seasonal and utilization efficiency of oil and gas heating systems as found in residences.

2. Investigate and demonstrate innovative controls.

3. Investigate new applications of existing products so that costs can be decreased and/or comfort and safety increased.

DELIVERABLES:

1. Documentation on current levels and future trends in seasonal and utilization efficiencies of oil and gas heating systems.

2. A technique to detect faulty chimney operation.

3. A repair technique for cracked or corroded oil furnace heat exchangers.

4. Technical assessment of a prototype return air plenum heater.

5. Technical assessment of a novel wireless, infra-red linked thermostat.

CONTACT: F.G. (Frank) Pellini (122+6886)

"Research Division/Utilization Section Programs 85/86"

SECTOR: Residential

TOPIC: Building Science

MARKET SEGMENT: Space Heating and Air Quality in New and Existing Housing Market

OBJECTIVE: Respond to Marketing enquiries and assess effects on the power system and electric equipment opportunities in the areas of thermal retrofits, ventilation, furnace sizing, windows, chimneys, appliances, etc.

1. Measure energy and demand effects, and assess homeowner concerns following thermal envelope upgradings.

2. Assess, in a new laboratory, ventilation effectiveness for indoor air quality and comfort ramifications of fresh air supply and distribution.

3. Support the development of and prove new heating/cooling load calculations.

4. Perform applications testing on new window developments (aerogel and IR reflective films) to aid market assessment.

5. Respond to chimney integrity concerns in brief field studies and help plan research.

DELIVERABLES:

1. Qualification of strategic conservation potential and problems in the retrofit area.

2. An operating ventilation test room and diagnostics, and preliminary assessment of appropriate system designs.

3. Proven computerized load calculator available in Marketing Operations.

4. Preliminary technical characterization of improved windows.

5. Recommendations for action re specific chimney system situations.

CONTACT: W.R. (Bill) Jones (122+6253)

"Research Division/Utilization Section Programs 85/86"

SECTOR: Residential

TOPIC: Residential Service Entrances

MARKET SEGMENT: Space and water heating in the new housing market. Supplementary heating. Electric dual-fuelled space heating.

OBJECTIVE: Improve the performance and reliability of residential service entrance and wiring equipment.

DETAIL:

1. Prepare guidelines for improving new and existing service entrances (CEA).
2. Identify methods of upgrading electric service entrances for the purpose of adding electric heating (CEA).
3. Identify methods of reducing service entrance fires (CEA).
4. Development of futuristic wiring systems for add-on electric heating.

DELIVERABLES:

1. Recommendations concerning the effect of tin-plating of fuses to improve reliability and customer satisfaction.
2. Recommendations concerning the use of breakers in residential electric heating applications.
3. Guidelines for improving residential service entrances.
4. Methods for minimizing fires arising from residential electrical service entrance panelboard failures.
5. Guidelines for upgrading existing residential service entrances for addition of electric heat.
6. Development and evaluation of meter base reinforcing springs for improved meter base reliability when electric heat is added.
7. Development of hardware to permit addition of baseboard heaters on existing branch circuit wiring.

CONTACT: C.E. (Carl) Keyes (122+6506)

"Research Division/Utilization Section Programs 85/86"

SECTOR: Commercial

TOPIC: Commercial Applications of Heat Pumps

MARKET SEGMENT: Multi-residential, Offices, Accommodation, Retail and Agricultural

OBJECTIVE: Support Commercial Marketing efforts by providing accurate technical information on the performance and operating characteristics of heat pump products for selected commercial markets.

DETAIL:

1. Finalize performance measurements of Canada's first large scale ground source heat pump demonstration project (Arc Rental site).

2. Assist engineering consultants in determining the performance of a large lake water heat pump at the Queen's Quay terminal building.

3. Evaluate ground source heat pumps for agricultural heating applications.

4. Keep abreast of technical innovation in exhaust air heat pumps for multi-family dwellings and internal source/"Tri-water" heat pumps for office buildings.

5. Survey available incremental heating/cooling systems suitable for the large luxury hotel accommodation sector.

DELIVERABLES:

1. Recommendations and guidelines covering the use of ground source heat pumps in commercial applications.

2. Evaluation of opportunities to use lakes as heat sources or heat sinks for commercial space conditioning.

3. Identification of new roles for heat pumps in agriculture and in the food industry.

4. Identification of incremental systems that provide quiter operation, long life, low maintenance and improved comfort.

CONTACTS: F.J. (Frank) Lenarduzzi (122+6506)
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"Research Division/Utilization Section Programs 85/86"

SECTOR: Commercial

TOPIC: Commercial Water Heating

MARKET SEGMENT: Multi-residential, Accommodation, Offices, Retail, Restaurants, Education, Recreation

OBJECTIVE: Meet the continually evolving need of the Corporation relative to efficient energy use for water heating purposes in the commercial sector.

Assist Marketing to increase the commercial water heating load by making recommendations to improve performance of existing electric water heaters, by implementing new water heating technologies and by evaluating the competition.

DETAIL:

1. Monitor the marketplace for innovative energy efficient water heaters and perform evaluation tests as required.

2. Compare performance and operating costs of electric versus natural gas water heating in apartment buildings.

3. Develop preliminary "typical" hot water use patterns in apartment buildings.

4. Document the performance and reliability of commercial heat pump water heaters and heat recovery systems through laboratory and field assessments.

5. Assess technical innovations to improve the thermal performance of existing water heaters and assist in developing novel heat recovery systems, energy saving devices and installation techniques.

6. Provide consultation to Commercial Marketing as required.

DELIVERABLES:

1. Measured performance of natural gas water heaters in apartment buildings.

2. Preliminary hot water consumption patterns in apartment buildings.

3. Measured performance of heat pump water heaters in restaurants.

4. List of opportunities and recommendations for the use of heat pump water heaters and other heat recovery systems in commercial applications.

5. Recommendations for optimization of thermal performance of existing water heating systems.

6. List of opportunities for new research areas in commercial/ institutional applications.

CONTACT: M. (Maier) Perlman (122+6196)